Citation:

Taveras EM, Berkey CS, Rifas-Shiman SL, Ludwig DS, Rockett HR, Field AE, Colditz GA, Gillman MW. Association of consumption of fried food away from home with body mass index and diet quality in older children and adolescents. *Pediatrics*. 2005 Oct; 116 (4): e518-524.

PubMed ID: 16199680

Study Design:

Prospective Cohort Study

Class:

B - Click here for explanation of classification scheme.

Research Design and Implementation Rating:

POSITIVE: See Research Design and Implementation Criteria Checklist below.

Research Purpose:

- To examine the cross-sectional and longitudinal associations between consumption of fried foods away from home (FFA) and body mass index (BMI)
- To examine the cross-sectional associations between intake of FFA and several measures of diet quality.

Inclusion Criteria:

- Children in this study were part of the Growing Up Today study, which included children who reside in 50 states, and are the offspring of Nurses' Health Study II participants
- At baseline, all children were between the ages of nine to 14 years.

Exclusion Criteria:

- Conditions that affect growth (juvenile rheumatoid arthritis, inflammatory bowel disease and cerebral palsy)
- Reported bingeing or purging
- Missing or implausible physical activity levels
- Missing BMI data
- Outlying BMI value
- Missing fried food intake data.

Description of Study Protocol:

Recruitment

Subjects were recruited in 1996 as the offspring of Nurses' Health Study II participants.

Design

Prospective cohort design with some cross-sectional analyses.

Dietary Intake/Dietary Assessment Methodology

- A number of questionnaire items were related to dietary intake
- 132-item semi-quantitative food-frequency questionnaire (FFQ) about dietary intake over the past year.

Statistical Analysis

- Linear regression models with estimating by generalized estimating equations was used to examine the cross-sectional relationship between consumption of FFA and BMI, adjusting for correlations among the small numbers of siblings in the cohort and the three-year longitudinal relationship between change in consumption of FFA and change in BMI, adjusting for correlated observations
- All models were fit separately for boys and girls, but results were combined and adjusted for gender when gender-specific estimates were similar
- Effect modification by age was assessed by examining the relationship between consumption of FFA and BMI within two baseline age strata: Nine to 12 years and 13 or more years
- The cross-sectional multivariate models that predicted BMI include the main predictor of interest, servings per week of FFA, as a categorical variable, unadjusted and adjust for potential confounding factors. Two groups of confounders were considered (sociodemographic and physical factors and physical activity or inactivity). These covariates were sequentially entered into the regression models of the outcome and main predictor
- For the multivariate longitudinal analyses, the relationship between change in consumption of FFA and annual change in BMI was assessed by combining the data from each of the three one-year intervals from 1996, 1997, 1998 and 1999. All models adjust for age, race/ethnicity and to account for increases in BMI that typically occur during the same year, menstrual history, Tanner stage, previous BMI z-score and non-linear age trends. Models also adjusted for activity and inactivity during the year of BMI change. Finally, total energy intake and dieting were included in additional separate models
- As secondary outcomes, the cross-sectional relationships between baseline servings per week of FFA and measures of both diet quality and total energy intake were examined.

Data Collection Summary:

Timing of Measurements

- Data were collected by means of an annual mailed self-administered questionnaire
- Data were collected in 1996, 1997, 1998 and 1999.

Dependent Variables

- Children self-reported their height and weight each year
- BMI was computed from these self-reported values.

Independent Variables

Intake of FFA was determined by the answer to "How often do you eat fried food away from home (e.g., French fries, chicken nuggets)?," with response categories of:

- Never or less than once
- One to three times per week
- Four to six times per week
- Daily.

Because the response to "daily," was sparse, the daily and four to six times per week categories were combined.

Control Variables

- Energy intake was determined using a 132-item semi-quantitative FFQ
- Physical activity and inactivity were determined via questionnaire
- Age, race/ethnicity, Tanner stage and dieting were all self-reported on questionnaires.

Description of Actual Data Sample:

- *Initial N:* 16,493
- *Attrition (final N):* 14,355
- *Age:* Nine to 14 years at baseline
- *Ethnicity:* 93.7% were non-Hispanic white
- *Anthropometrics*
  - Nine- to 12-year-old girls at baseline had a BMI of 18.4kg/m^2
  - 13- to 14-year-old girls at baseline had a BMI of 20.2kg/m^2
  - Nine- to 12-year-old boys at baseline had a BMI of 19.2kg/m^2
  - 13- to 14-year-old boys at baseline had a BMI of 19.3kg/m^2
- *Location:* United States.

Summary of Results:

Consumption of FFA

- At baseline, 3.5% of girls and 6.0% of boys reported consuming four to seven servings per week of FFA. Girls and boys 13 to 14 years of age consumed more FFA than those between the ages of nine and 12 years
- By 1999, 7.5% of girls and 12.7% of boys consumed four to seven servings per week of FFA.

FFA and BMI at Baseline

After adjusting for age, gender, race/ethnicity, Tanner stage, menarche and physical activity and inactivity, BMI was found to be greater across increasing categories of FFA in boys only.

Frequency of FFA	All, BMI	Girls, BMI	Boys, BMI
Never or less than once a week	19.1 (0.13)	19.0 (0.21)	19.0 (0.18)
One to three times a week	19.2 (0.13)	19.1 (0.21)	19.2 (0.18)

Four to seven times a week	19.3 (0.18)	19.1 (0.27)	19.3 (0.24)
Trend P	0.002	0.21	0.02

Consumption of FFA and Change in BMI at Follow-up

- Children who increased their consumption of FFA from "never or less than once a week" to "four to seven times a week" gained 0.21kg/m^2. Estimates were similar for girls and boys
- Children in the intermediate categories of FFA consumption had only small, non-significant BMI changes over the one-year period
- Boys who decreased their consumption of FFA from "four to seven times a week" to "never or less than once a week" decreased their BMI; however, girls who decreased their consumption of FFA from "four to seven times a week" to "never or less than once a week" gained weight.

Previous Year Consumption of FFA	Change in BMI	
	Never or Less than Once a Week	Four to Seven Times a Week
All, never or less than once a week	0.0 (ref)	0.21 (0.03 to 0.39)
All, four to seven times a week	-0.03 (-0.25 to 0.19)	-0.09 (-0.22 to 0.05)
Girls, never or less than once a week	0.0 (ref)	0.19 (-0.05 to 0.43)
Girls, four to seven times a week	0.27 (-0.02 to 0.56)	0.05 (-0.15 to 0.25)
Boys, never or less than once a week	0.0 (ref)	0.22 (-0.06 to 0.49)
Boys, four to seven times a week	-0.31 (-0.62 to 0.00)	-0.12 (-0.39 to 0.06)

Fried Food Consumption, Diet Quality and Total Energy Intake

Participants who ate FFA reported higher intakes of total energy, whole dairy foods, sugar-sweetened beverages, red and processed meats and trans fat, as well as high glycemic loads. They also consumed less low-fat dairy foods, fruits and vegetables, had a lower ratio of polyunsaturated-to-saturated fats and consumed fewer multivitamins (P<0.0001).

Author Conclusion:

- Older children who consume greater quantities of FFA are heavier, have greater total energy intakes and have poorer diet quality
- Furthermore, increasing consumption of FFA over time may lead to excess weight gain.

Reviewer Comments:

- *BMI was used as a surrogate measure of adiposity in this study*
- *BMI was calculated based on self-reported height and weight*

- *This study only assessed fried food consumed away from home, and did not assess fast food consumption or food purchased away from home directly.*

Research Design and Implementation Criteria Checklist: Primary Research

Relevance Questions

1.	Would implementing the studied intervention or procedure (if found successful) result in improved outcomes for the patients/clients/population group? (Not Applicable for some epidemiological studies)	N/A
2.	Did the authors study an outcome (dependent variable) or topic that the patients/clients/population group would care about?	N/A
3.	Is the focus of the intervention or procedure (independent variable) or topic of study a common issue of concern to nutrition or dietetics practice?	N/A
4.	Is the intervention or procedure feasible? (NA for some epidemiological studies)	N/A

Validity Questions

1.	**Was the research question clearly stated?**	Yes
1.1.	Was (were) the specific intervention(s) or procedure(s) [independent variable(s)] identified?	Yes
1.2.	Was (were) the outcome(s) [dependent variable(s)] clearly indicated?	Yes
1.3.	Were the target population and setting specified?	Yes
2.	**Was the selection of study subjects/patients free from bias?**	Yes
2.1.	Were inclusion/exclusion criteria specified (e.g., risk, point in disease progression, diagnostic or prognosis criteria), and with sufficient detail and without omitting criteria critical to the study?	Yes
2.2.	Were criteria applied equally to all study groups?	Yes
2.3.	Were health, demographics, and other characteristics of subjects described?	Yes
2.4.	Were the subjects/patients a representative sample of the relevant population?	Yes
3.	**Were study groups comparable?**	Yes
3.1.	Was the method of assigning subjects/patients to groups described and unbiased? (Method of randomization identified if RCT)	N/A
3.2.	Were distribution of disease status, prognostic factors, and other factors (e.g., demographics) similar across study groups at baseline?	Yes

3.3.	Were concurrent controls used? (Concurrent preferred over historical controls.)	Yes
3.4.	If cohort study or cross-sectional study, were groups comparable on important confounding factors and/or were preexisting differences accounted for by using appropriate adjustments in statistical analysis?	Yes
3.5.	If case control or cross-sectional study, were potential confounding factors comparable for cases and controls? (If case series or trial with subjects serving as own control, this criterion is not applicable. Criterion may not be applicable in some cross-sectional studies.)	N/A
3.6.	If diagnostic test, was there an independent blind comparison with an appropriate reference standard (e.g., "gold standard")?	N/A
4.	**Was method of handling withdrawals described?**	Yes
4.1.	Were follow-up methods described and the same for all groups?	Yes
4.2.	Was the number, characteristics of withdrawals (i.e., dropouts, lost to follow up, attrition rate) and/or response rate (cross-sectional studies) described for each group? (Follow up goal for a strong study is 80%.)	Yes
4.3.	Were all enrolled subjects/patients (in the original sample) accounted for?	Yes
4.4.	Were reasons for withdrawals similar across groups?	???
4.5.	If diagnostic test, was decision to perform reference test not dependent on results of test under study?	N/A
5.	**Was blinding used to prevent introduction of bias?**	Yes
5.1.	In intervention study, were subjects, clinicians/practitioners, and investigators blinded to treatment group, as appropriate?	N/A
5.2.	Were data collectors blinded for outcomes assessment? (If outcome is measured using an objective test, such as a lab value, this criterion is assumed to be met.)	N/A
5.3.	In cohort study or cross-sectional study, were measurements of outcomes and risk factors blinded?	Yes
5.4.	In case control study, was case definition explicit and case ascertainment not influenced by exposure status?	N/A
5.5.	In diagnostic study, were test results blinded to patient history and other test results?	N/A
6.	**Were intervention/therapeutic regimens/exposure factor or procedure and any comparison(s) described in detail? Were interveningfactors described?**	Yes
6.1.	In RCT or other intervention trial, were protocols described for all regimens studied?	N/A

6.2.	In observational study, were interventions, study settings, and clinicians/provider described?	Yes
6.3.	Was the intensity and duration of the intervention or exposure factor sufficient to produce a meaningful effect?	Yes
6.4.	Was the amount of exposure and, if relevant, subject/patient compliance measured?	Yes
6.5.	Were co-interventions (e.g., ancillary treatments, other therapies) described?	Yes
6.6.	Were extra or unplanned treatments described?	Yes
6.7.	Was the information for 6.4, 6.5, and 6.6 assessed the same way for all groups?	Yes
6.8.	In diagnostic study, were details of test administration and replication sufficient?	N/A
7.	**Were outcomes clearly defined and the measurements valid and reliable?**	Yes
7.1.	Were primary and secondary endpoints described and relevant to the question?	Yes
7.2.	Were nutrition measures appropriate to question and outcomes of concern?	Yes
7.3.	Was the period of follow-up long enough for important outcome(s) to occur?	Yes
7.4.	Were the observations and measurements based on standard, valid, and reliable data collection instruments/tests/procedures?	No
7.5.	Was the measurement of effect at an appropriate level of precision?	Yes
7.6.	Were other factors accounted for (measured) that could affect outcomes?	Yes
7.7.	Were the measurements conducted consistently across groups?	Yes
8.	**Was the statistical analysis appropriate for the study design and type of outcome indicators?**	N/A
8.1.	Were statistical analyses adequately described and the results reported appropriately?	Yes
8.2.	Were correct statistical tests used and assumptions of test not violated?	Yes
8.3.	Were statistics reported with levels of significance and/or confidence intervals?	Yes
8.4.	Was "intent to treat" analysis of outcomes done (and as appropriate, was there an analysis of outcomes for those maximally exposed or a dose-response analysis)?	No
8.5.	Were adequate adjustments made for effects of confounding factors that might have affected the outcomes (e.g., multivariate analyses)?	Yes

8.6.	Was clinical significance as well as statistical significance reported?	Yes
8.7.	If negative findings, was a power calculation reported to address type 2 error?	No
9.	**Are conclusions supported by results with biases and limitations taken into consideration?**	Yes
9.1.	Is there a discussion of findings?	Yes
9.2.	Are biases and study limitations identified and discussed?	Yes
10.	**Is bias due to study's funding or sponsorship unlikely?**	Yes
10.1.	Were sources of funding and investigators' affiliations described?	Yes
10.2.	Was the study free from apparent conflict of interest?	Yes